EXHIBIT 6 (Part 10)

Deposition of David Repka Exhibits 19. 127

FILED UNDER SEAL

DEPOSITION EXHIBIT

19

FILED UNDER SEAL

To: Beach, Clifford L Jr[clbeach@tva.gov]
Cc: Chandler, Christopher C[ccchandler0@tva.gov]; Quirk, Sherry Ann[saquirk@tva.gov]; Matthews, Timothy P.[timothy.matthews@morganlewis.com]; Franklin Haney, Sr.[flh@flhcompany.com]; Frank Haney[frankhaney@flhcompany.com]; bill@wrmccollum.com[bill@wrmccollum.com]
From: Larry D. Blust
Sent: Mon 11/12/2018 5:00:10 PM
Subject: License Transfer Issues
2018_11_12_14_48_24.pdf

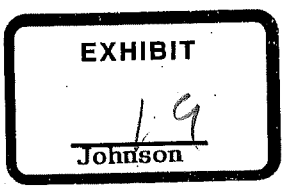
TVA External Message. Please use caution when opening.

Thanks for sending your discussion points on the license transfer issue on Friday. In our call Thursday, I briefly explained ND's proposed path forward to transfer the construction permits in deferred status by filling the application before closing with the approval to occur after closing and stated that we agreed with you that this would be a case of first impression for the NRC, that the NRC would likely prefer that the its approval occur before closing as would we and that this was the main reasons we had requested an extension of the closing date.

I also said that I would discuss this with Tim Matthews of Morgan Lewis who, as you know, is the NRC licensing attorney handling our application, and get back to you as to his comments. I talked to him Friday and sent him your bullet points. I received from him the attached response.

Based on your analysis< TVA cannot perform its obligation to transfer the plants until a license transfer has received NRC approval and would be in breach of contract unless the closing date is extended. Although there is some difference between Tim's position and yours, I think we are all in agreement that the safe way to do this is to close after NRC approval of the construction permit transfers. Otherwise both parties incur risks which can be easily avoided. As Tim states in his writeup, NRC has reviewed and approved transfers in as few as 6 months if necessary to meet a project deadline. Per Tim, the best way to get NRC to expedite the transfer approval is to provide NRC with a closing date at least 6 months out that NRC can aim for. Any period shorter than this is unrealistic. We are filing the transfer application today for NRC receipt tomorrow since today is a federal holiday. We would still like to get from you the letter Tim requested some time ago.

In summary, we think it is in both parties' interest to extend the closing date by at least 6 months as we requested some time ago and as you were considering. This can be done by a simple second amendment like the first amendment you drafted. Please call me asap regarding this.



Regulatory Path Forward for Transfer of the Bellefonte Construction Permits

NRC issued to TVA Construction Permits (CPs) (CPPR-122 and -123) pursuant to Section 103 of the Atomic Energy Act of 1954, as amended (AEA) "for a utilization facility" (Section 2), and specifically "authorize[d] the applicant to construct the facility described in the application" (Condition 3.C).

The CPs may not be transferred without the prior written consent of the NRC. 10 CFR 50.80, implementing AEA Section 103.a. While it would be preferable to transfer the CPs contemporaneous with the land and improvements, both following receipt of NRC consent, transfer of the Bellefonte site and its improvements in their current condition does not appear to violate the permits, NRC regulations or the AEA.

Nuclear Development (ND) anticipates submitting a sufficient and high quality NRC application for transfer of the CPs prior to closing on the PSA. In the less preferable case of transfer of the site prior to receipt of NRC consent for transfer of the CPs, ND will specifically request that NRC hold in abeyance any action on the CPs until such time as the agency reaches a decision on ND's transfer request, and then address the CPs consistent with that action (i.e., transfer or terminate the CPs). ND generally described its approach for the transfer of the CPs, including the closing date, to the NRC Staff at an August public meeting; NRC has not raised objections there or since.

ND views Section 2 of the CPs as a description of the type of license and limitations thereon rather than an express authorization to "acquire, possess or use" under Section 103. Specifically, CP Section 2 appears to describe a construction permit "for" a utilization facility, to use the possessive "applicant's site" in the description of the location. ND recognizes ownership or control of the site as a prerequisite for authorized construction and similarly recognizes TVA's responsibility as the permit holder to consider and resolve potential ambiguity regarding the permits.

ND acknowledges that this regulatory path -- involving temporary separation of ownership of a site for a utilization facility from the recipient of the permits authorizing its construction -- appears to be a situation of first impression for the NRC without clear precedent and results in a degree of responsibility and risk to TVA after closing until the CP transfers are approved. Accordingly, it would be preferable from the standpoint of both parties to extend the time for closing on the transaction until such time as TVA and ND have received NRC's prior written consent, but ND is prepared to move forward on this alternative path under the current agreement if necessary. NRC has reviewed license transfer applications in as few as six months if necessary to meet a project deadline. We understand ND has requested TVA consider an extension of the closing date to accommodate NRC consent prior to closing.

DEPOSITION EXHIBIT

127

FILED UNDER SEAL

BELLEFONTE NUCLEAR PLANT UNIT 1 AND COMMON COMPLETION PROJECT

DETAILED SCOPING, ESTIMATING, AND PLANNING STUDY REPORT

Nuclear Generation, Development and Construction Group

March 22, 2010

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

1.1 Project Information

Background

This Detailed Scoping, Estimating, and Planning (DSEP) report documents the results of analysis that was performed over a one-year period to evaluate the scope, cost, schedule, and risks for completing Bellefonte Unit 1 and Common[1].

An integrated team led by TVA, with assistance from several major contractors, completed over 150,000 labor hours of work for this effort. The DSEP team performed the following scope:

- Detailed review of selected plant systems to determine material condition and document missing equipment.
- Detailed review of the application of current regulatory requirements and potential application of developing or new plant regulations.
- Review of investment recovery (i.e., removed equipment and material) impacts.
- Detailed assessment of project risks and associated mitigation opportunities.
- Review of operating experience to identify reliability improvements.
- Review and incorporation of previous estimates, which included definitive, budgetary, and order of magnitude information.
- Development of a consolidated cost estimate and schedule at a 90% confidence level.
- Development of an execution strategy defining implementation of major programs, contracting strategy, and project roles and responsibilities among major stakeholders.

Plant Characteristics

The Bellefonte Unit 1 plant consists of:

- A Babcock & Wilcox (B&W) 205 reactor rated at 3600 megawatts thermal (MWt) / 1260 megawatts electrical (MWe), which includes an upgrade of approximately 50 MWe from a planned steam path upgrade.
- A Brown Boveri Steam Turbine (2LP/1HP) and a hydrogen-cooled generator.
- TVA was the original plant Architect-Engineer and Constructor.
- Natural draft cooling towers.
- Unit 1 was 90% physically complete in 1988. An investment recovery effort from 2005 to 2007 removed material and equipment. Due to this effort, addition of scope during DSEP and planned equipment refurbishment, the current completion estimate is 55%.

The Bellefonte site contains a second identical unit that was completed to approximately 58% in 1988, and is currently estimated to be 35% complete, for the same reasons listed above.

---

1. *From this point on in the report, all references to Bellefonte will signify Bellefonte Unit 1 and Common.*

The Bellefonte Nuclear Plant (BLN) design was developed by B&W and is an evolutionary design from the B&W 177 design currently employed at seven nuclear units in the U.S. AREVA currently supports the B&W designed operating plants and will serve as the Nuclear Steam Supply System (NSSS) vendor for Bellefonte.

One B&W 205 plant, Mulheim-Karlich (M-K), was licensed and started up in Germany in 1987. The plant operated at a high capacity factor for about one cycle. This plant was subsequently shut down because of administrative issues in the licensing process. The B&W 205 is a third-generation design, and the operating experience obtained from Mulheim-Karlich will be instrumental in completing the design for the Bellefonte plant. TVA plans to use the precedence of the B&W operating fleet for certain "families" of operating-experience-related industry issues.

Figure 1-1 shows a timeline of major milestones for Bellefonte from beginning of construction to the present.

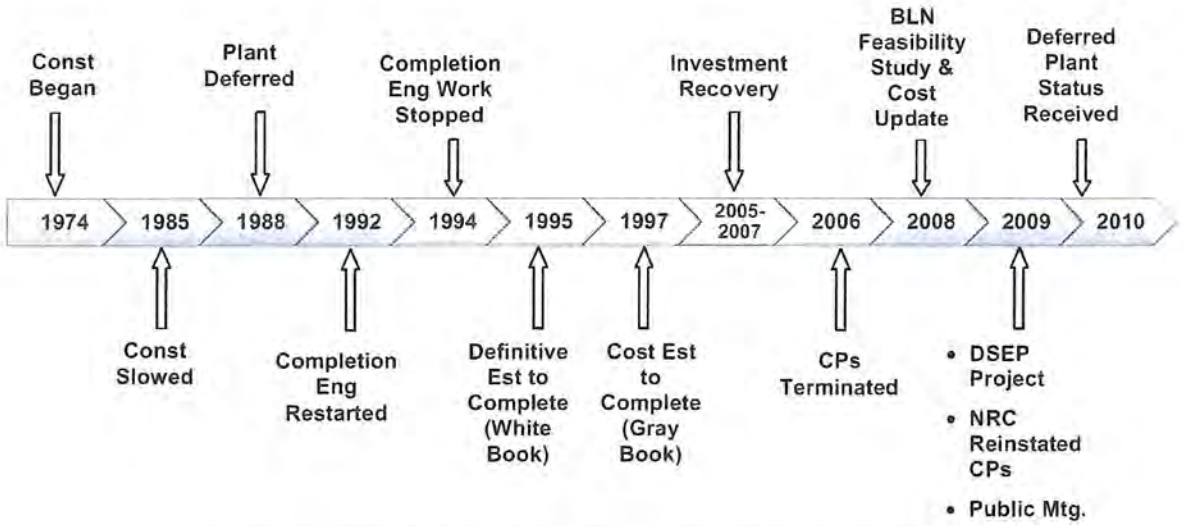


Figure 1-1. Major Milestones During Bellefonte's History

1.2 Teams

Multiple teams were involved in the preparation of the Bellefonte DSEP including:

- TVA
- AREVA
- Alstom
- B&W - Canada
- Bechtel
- Burns and McDonald
- Huron
- MESA
- Pro2Serve
- Project Time and Cost (PT&C)
- Sargent & Lundy
- URS
- Worley Parsons

An Independent Assessment Team Review of the DSEP process was performed at the midway point. This team's input was used to improve the final integrated analysis that the DSEP team produced, and to focus activities going forward. The team was composed of industry experts who are familiar with the technologies, regulations, and processes related to the nuclear industry and TVA in particular. Most of the team members also have direct TVA experience. Table 1-1 briefly summarizes their qualifications.

The team performed a follow-up review at the end of the DSEP effort to review the final results for completeness and accuracy. The team stated that currently there is sufficient cost, schedule, and risk information for TVA management to make a decision whether to go forward with completion of BLN Unit 1.

Table 1-1. Independent Assessment Team Members

TEAM MEMBER	RELEVANT QUALIFICATIONS
Raymond K. Alexander, Sr. VP, Manager of Eng. for Pro2Serve	• 34 years of experience in operating and managing large engineering design projects. • Responsible for construction project reviews for DOE for the Oak Ridge Highly Enriched Uranium Material Facility. • Performed technical reviews for 4 new commercial nuclear power stations under 10 CFR 52 COLA requirements. • Was TVA's point of contact and representative for design and construction to NUSTART for the AP1000 at Bellefonte. • Was Manager of Corporate Nuclear Engineering and Design at TVA.
Marci Cooper, Utility & Power Industry Consultant	• 27 years of power industry experience in technical, regulatory, managerial, project management, and executive positions. • Extensive nuclear licensing experience including serving as Licensing Manager and Restart Manager at TVA's Sequoyah units. • Developed, directed, and managed restart plan at Sequoyah. • Was Sr. VP, Fossil Engineering & Technical Services, at TVA, and Site General Manager at Widows Creek.
Ray Ganthner, Sr. VP, Retired, AREVA	• 40 years of experience in all aspects of commercial nuclear energy. • Established and led the introduction of EPR reactor technology to the U.S. • Was VP for Bellefonte Completion in 1991-1993, leading the effort to restart engineering, licensing, and construction. Bellefonte project was fully staffed with a work force of over 800 and operating with an annual budget of over $100M.
George Geany, Director of MPR's Nuclear Services Group	• 30 years of experience with nuclear power production. • Responsible for management of MPR's services provided to domestic and international nuclear industries. Provides project management, systems evaluations, design and licensing bases, and plant and component performance analysis. • Recent projects include calculation design basis reconstitution, power uprate planning, new plant design reviews, and client support in preparing for NRC inspections.
Dave Stinson, President of Shaw AREVA MOX Services	• 33 years of experience in government and commercial sectors. • Founded Digital Engineering, which became a 300-person software and engineering company developing expert systems for conducting safety analysis for commercial nuclear facilities. • Project Manager for the $1.5B recovery of Browns Ferry Unit 3, which was completed 6 months ahead of schedule and $120M under budget.

1.3 Key Conclusions and Project Assumptions

The following conclusions and assumptions are offered as a result of the DSEP study:

- The estimated project duration is 90 months at a cost of $3.71 billion dollars, with a cost contingency of $430 million. This assumes a project approval in August 2010, and a commercial operating date of October 2017.
- With all schedule risks accounted for, the total project schedule will be 96 months with an increase in contingency cost of $70 million, for a total of $500 million in contingency.
- The project estimate is in 2009 dollars and does not include any AFUDC (or escalation) in the estimate for future years or the cost of the initial fuel procurement.
- The project critical path goes through Instrument and Controls (I&C) design, which is a prerequisite for simulator design and procurement. The simulator is needed for operator training and licensing. Operator licensing is required prior to initial fuel loading and power ascension testing.
- The next near-critical path is through procurement and installation of steam generators. To reduce schedule risk, forging slot reservations were contracted with Japan Steel Works (JSW) in November 2008 in order to ensure a steam generator delivery date in 2015. A letter of intent is signed with Babcock & Wilcox Canada (BWC) for delivery of steam generators in June 2015, 62 months after contract award.
- The Engineering reviews performed during the DSEP found no concerns that would prevent the Bellefonte project from proceeding forward to completion.
- The material condition of plant system, structures, and components is consistent with that expected for a plant that has been deferred for over 20 years. Many components will need to be replaced or refurbished to meet design or performance standards. This has been included in the project estimate.
- The plant is structurally sound. There are some ongoing evaluations of the containment post-tensioning system as well as some water in-leakage problems that will need to be further assessed and evaluated, and have the potential for additional scope of work. These evaluations are included in the DSEP scope. Reasonable assumptions have been made in the estimate regarding the likely work scope from these evaluations and captured in project contingency.
- Historical quality-related documentation and records have been able to be identified, are retrievable, and are in satisfactory overall condition.
- The impact of Investment Recovery (IR) activities has been investigated, identified, and documented. Engineering, material, and construction costs associated with IR have been addressed in the project estimate and schedule.
- The bulk of engineering work will be developing issuance of design output and establishing and documenting the plant licensing Design Basis.
- The existing analog and solid state I&C systems will be replaced with digital technology that has been licensed for similar nuclear applications. Although licensing for the BLN

application will be a substantial effort, it is believed to be more predictable than reverse engineering and qualification of the existing obsolete technology. However, regulatory issues with Oconee during installation and testing could affect BLN.

- Engineering, initial construction planning, and licensing activities are assumed to commence immediately following project approval. Active construction is assumed to resume in July 2012, with the goal of design activities being sufficiently ahead of construction so as not to cause construction delays. The design goal will be 90% area completion prior to construction.
- Facilities construction activities are assumed to commence early in the project to support active construction and plant staffing. Critical facility needs include a training center to support simulator construction and operator training.
- Facility design and construction work will be aimed at gaining Leadership in Energy and Environmental Design (LEED) Gold certification for the site. Lighting systems, HVAC systems, plumbing fixtures, and insulation will employ energy efficient technology, to the extent practical. The use of hybrid or electric vehicles will be encouraged through preferred parking and recharging stations.
- AREVA has committed to support the Bellefonte B&W 205 technology by providing design basis, licensing basis, licensing support, and startup support as necessary to achieve the licensing and startup of Bellefonte.
- The BLN project will have many similarities with the Browns Ferry Unit 1 (BFN1) and Watts Bar Unit 2 (WBN2) projects. Lessons learned and plant operational aspects have been incorporated into planning for Bellefonte completion. Specifically, the BLN refurbishment program will be based on the previous programs.
- Although there are similarities, a comparison of scope for previous TVA restart/recovery projects indicates that Bellefonte will have many unique scope items:
    - B&W's 205 design has not been licensed in the U.S.
    - Major components have been affected by Investment Recovery effort.
    - Major facility construction/renovation.
    - Complete development of plant staff and operations programs.
    - Engineering design and licensing basis is not yet complete.
- TVA will award and manage major contracts as required to complete construction of Bellefonte. This plan includes:
    - Multiple Engineering contracts.
    - Multiple Construction contracts.
    - Separate Facilities construction contractor.
    - Use of TVA processes and infrastructure.
    - Significant TVA support and oversight role to ensure consistency, integration, and control across contractors.
- Various contract structures will be used including fixed price, cost plus with fee at risk, and others as appropriate. Incentives will be tied to both individual and project goals.

- A steam path upgrade is planned to increase plant net output from 1217 MWe to 1260 MWe. This upgrade will come from an improvement in overall turbine efficiency through the replacement of the HP and both LP rotors.
- New plant regulations have been evaluated, and design changes as needed have been incorporated into the overall estimate. This includes changes in seismic criteria, aircraft hazard rule, containment sump modifications, and Alloy 600 upgrades.
- Throughout the Unit 1 completion effort, consideration will be given to preserve future options, including completion of Unit 2 and construction of AP1000 Units 3 and 4. The project will ensure that Unit 2 is protected as an asset.

1.4 Project Risks

Major project risks are explained below.

- **Instruments and Controls (I&C)** – Three major risks are associated with the I&C scope planned for Bellefonte: Technology Risks, Licensing Risks, and Contractual Risks. These are being managed as follows:
  - **Technology Risks**- The extent of digital I&C planned for Bellefonte has been installed and used successfully in other countries but not in the United States. Although the Kepner-Tregoe (KT) analysis indicated that digital is the right technology for this project, there are new risks that come with a full digital system. As a result of these risks, a parallel path will be maintained for the first year for design of an analog system. This effort will ensure critical path time is not lost, should difficulties be discovered, either with the design of BLN, or if Oconee has significant problems with their implementation.
  - **Licensing risk**- Although the licensing risks are reduced with Oconee's NRC approval, there are still challenges because of the increased amount of digital I&C to be installed at BLN. Risk in this area is being mitigated by planning an extensive, prescheduled set of meetings with the NRC, early in the project and continuing throughout, to ensure good alignment and limited, last minute NRC concerns. This risk is believed to be more likely than either Technology or Contractual risks to impact the schedule and is included in the "6-month extension" contingency.
  - **Contractual risk**- There is not a signed contract with AREVA. The exact scope of such a contract has not been fully agreed upon, so the potential for a difference in scope or pricing could occur as the contract is being negotiated. As a result, there is $100 million earmarked in project risk for this risk.
- **License Hearing Process / Licensing Basis** - The review for BLN will require a full Safety Evaluation of all existing systems and any changes incorporated into the final Bellefonte design. Additionally, all programs associated with the safe maintenance and operation of Bellefonte will be included in the Operating License (OL) review. Because of some unique design aspects and upgraded features that are planned for Bellefonte, such as digital instrumentation and controls, the licensing review and hearing process

could challenge the projected commercial operation date. Additional challenges may come as the project addresses other significant licensing issues such as seismic design, fire protection, and issues associated with the previous withdrawal of the BLN Construction Permits.

- To ensure that critical licensing issues will not cause project delays, licensing work is scheduled to start early. Planning for these actions will ensure that the design concept is reviewed with the NRC early and any significant regulatory concerns are addressed in support of timely issuance of an operating license.
- TVA's proposed approach for obtaining the OL for BLN is modeled after the WBN2 approach and includes the following four key activities:
  1. Applying Generic Letter 87-15 "Commission Policy Statement on Deferred Plants."
  2. Reviewing and completing all outstanding regulatory items.
  3. Supplementing / amending the BLN OL application.
  4. Extending the existing construction permit to allow completion of construction and testing.
- As part of the DSEP activities, TVA reviewed new regulations, Bulletins, and Generic Letters issued since the time when construction was suspended. TVA intends to resolve items identified during this review as part of the licensing process. In addition, resolution of Watts Bar and Bellefonte construction permit reinstatement contentions, and proactively tracking industry-wide hearings, will provide insight into what challenges to expect regarding the updated Bellefonte operating license application.

A detailed plan has been laid out to meet with the NRC early and regularly to ensure clear understanding and agreement for approaches to important regulatory issues such as incorporation of the aircraft rule, changes to seismic criteria, and containment sump modifications. To the extent possible, TVA has built into the planned design changes those modifications that will be needed to ensure regulatory concerns will not impact final licensing of the facility.

- **Seismic** - There is uncertainty regarding the potential requirement to requalify plant Systems, Structures, and Components (SSCs) to new seismic criteria. The current approach is to obtain regulatory certainty so that rework of civil analyses to a different seismic spectra will not be required after significant work has been completed for the project. A panel of seismic experts performed an evaluation to provide insight into the likely impact of code changes. Contingency funding of $50 million has been identified in the estimate to address this issue if required.
- **Vertical Containment Tendons** - A tendon coupling failure during the DSEP period and the recent issues with the improper detensioning at the Crystal River containment design require a more complete analysis. Based on this risk and initial full scope estimate to repair, contingency money has been allocated to deal with this risk.
- **Underground Piping** - The current Bellefonte design contains significant runs of safety-related underground piping. Underground piping has been an industry issue, and a more

exhaustive study must be undertaken to determine the status of buried piping. An initial review is currently being performed. Contingency money has been identified in the estimate to perform any needed repairs.

- **Craft Staffing** – The construction outlook for 2012 to 2017 has been monitored closely during the DSEP period. Although there were concerns early with availability of skilled craft, the outlook has improved due to the delay of competing nuclear projects. In addition, construction will not begin on a second major project while one is still in progress. The timing for start of construction of Unit 1 is scheduled to coincide with completion of the WBN2 project. The availability of both adequate planning time and contingency money to provide craft incentives if the labor market changes significantly should preclude this from being a significant risk to the final project cost.
- **Nuclear Experienced Personnel** – Due to the number of personnel required to plan and perform the work, the project may experience difficulty in its ability to recruit sufficient numbers of manual and non-manual personnel with prior nuclear experience. Without a high percentage of experienced nuclear workers, productivity impacts could affect project costs while the workers learn the nuclear specific procedures and processes. Contingency plans will be developed, which may include retention incentives and/or additional job-specific training.
- **T-hot (Temperature hot)** – The current Bellefonte design includes a planned T-hot of 627° F. A survey shows that the maximum T-hot of any plant in the United States is currently at 620° F. While there are plants outside the U.S. that operate at higher temperatures, having an elevated temperature poses a licensing risk. This risk has developed since the construction permits were initially issued. Options being evaluated include engineered solutions that would allow the same reactor heat output at full power with the same, or a lower overall T-hot. Solving this risk could also involve a lower reactor heat output which could change our licensing approach.

2 BASIS, QUALIFICATIONS, AND ASSUMPTIONS

The comprehensive DSEP process began with detailed previous assessments and then built in updates in regulations, technology, and scope. Figure 2-1 provides a high-level overview of the project scope.

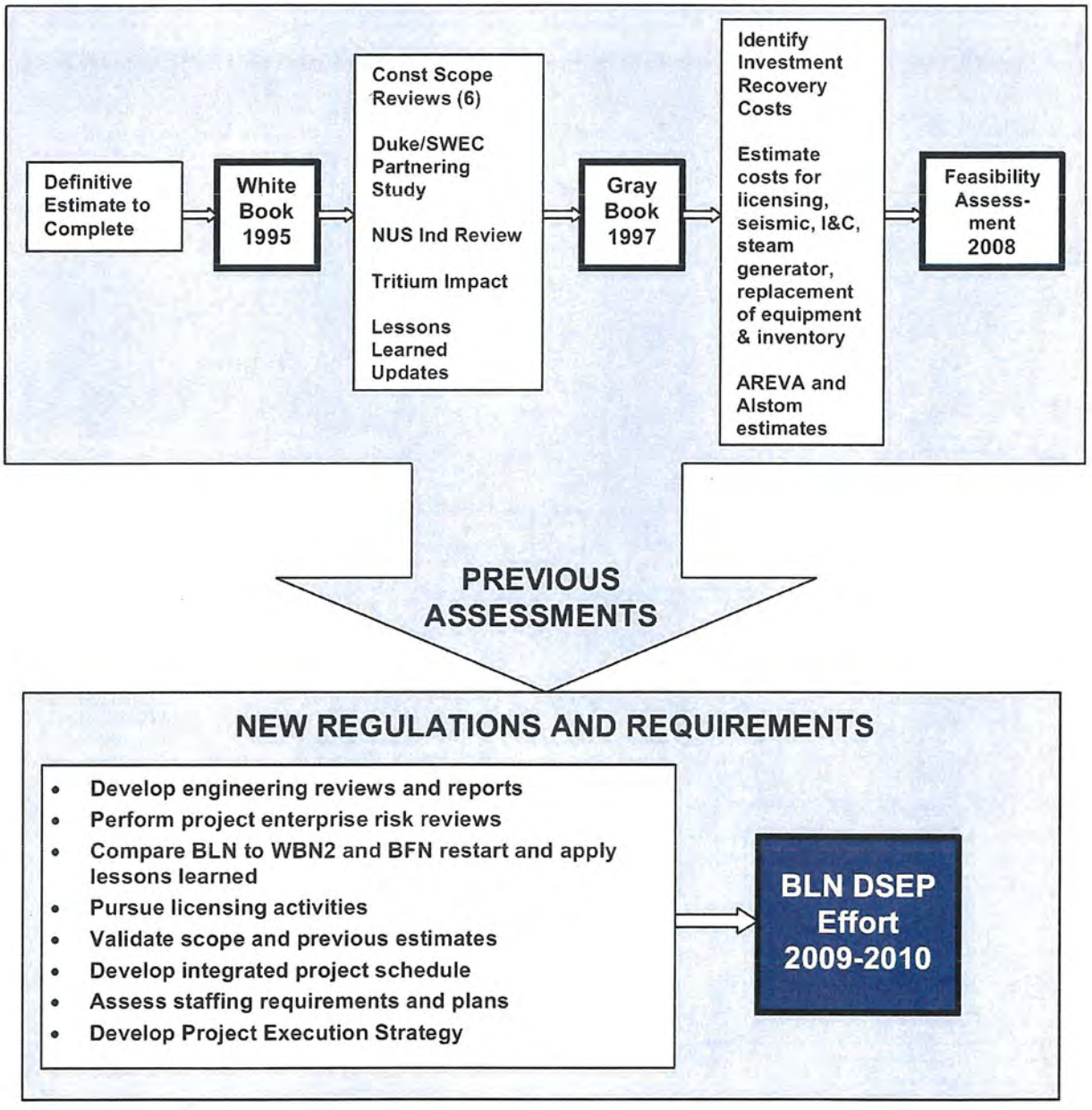


Figure 2-1. DSEP Project Scope

2.1 Engineering Methodology

Engineering reviews performed during the Bellefonte DSEP included a detailed analysis of the current condition of plant equipment as well as an evaluation of industry lessons learned for the systems and components that were designed for Bellefonte.

The TVA team and multiple engineering partners completed detailed reviews in over 70 specific areas. The focus of these reviews included the following primary factors:

- Identifying remaining engineering work to complete Bellefonte Unit 1.
- Investigating outstanding regulatory or technical issues.
- Reviewing changes in regulatory requirements since deferral.
- Evaluating the condition of engineering records.
- Incorporating industry operating experience.
- Incorporating relevant Nuclear Energy Institute (NEI), Institute of Nuclear Power Operations (INPO), and Owners Group guidance.
- Through walkdowns, identifying gaps in construction status and actual installed plant equipment for each affected task or review.

The Engineering scope for completion of Bellefonte is to:

- Establish and/or confirm the Design Basis for Bellefonte in accordance with applicable licensing regulatory requirements.
- Establish Baseline Design Documentation.
- Generate and issue required design changes to bring Bellefonte in compliance with design bases.
- Establish engineering programs to support plant construction and operation.
- Resolve previous open items and issues associated with Bellefonte.
- Provide engineering support to construction and startup activities.
- Manage and provide oversight for engineering contractors.

The Engineering effort has been estimated and can be described in the following areas:

- Design Output.
- Design Baseline Programs.
- Corrective Action/Open Item Closure.
- Management and Oversight of Engineering Programs and Processes.

Design Output

Physical changes to the plant will be required to address licensing and regulatory issues, closure of corrective action and open items, replacement of obsolete or aging equipment, and to upgrade plant systems and components to improve plant performance and efficiency.

Previous open Bellefonte design changes were reviewed and evaluated as part of the DSEP engineering reviews and resource estimates performed. Additional resources have been added to the estimate to address the needs resulting from this review.

Additional engineering resources were also identified and estimated as part of other system, component, or program engineering reviews performed during the BLN DSEP. These resources have been reviewed and reconciled with the resources included in the Definitive Estimate.

Design Baseline Programs

A specific task was performed to review, evaluate, and identify activities required to establish and document the Design Basis of the Bellefonte plant in a similar manner as has been done for all other TVA nuclear plants. This review included the following areas related to the Design Baseline effort:

- Design Baseline Documents.
- Engineering Calculations.
- Engineering Databases and Applications.
- Engineering Procedures.

This review identified the required activities and resources to establish the Design Baseline, and these have been included in the estimate.

Corrective Action/Open Items Closure

Open items that existed at the time of deferral were reviewed and evaluated as part of the engineering DSEP effort. This included open Non-Conformance Reports (NCRs), Corrective Action Program Documents, NRC Commitments, and Bellefonte Open Item Lists (TROI, COIL, CATDs, BOIL, etc.).

Required resources for closure of these items have been included in the estimate.

Management and Oversight of Engineering Programs and Processes

This category includes the level of effort activities necessary to:

- Develop and manage engineering programs necessary at Bellefonte.
- Develop and manage engineering processes and procedures to be used by Bellefonte personnel during construction.
- Provide engineering support for construction and testing activities.
- Provide management and oversight of TVA engineering partners.

Examples of identified programs in this category include Environmental Qualification (EQ), ASME Section III, Air Operated Valves/Motor Operated Valves (AOV/MOV), Computer Aided Design and Drafting (CADD) Drawing conversions, Fire Protection Program, Probabilistic Risk Analysis (PRA), and Technical Manual Program management.

Resources for these activities have been evaluated and included in the estimate.

2.2 Construction Methodology

The methodology used to develop the estimate for completion of construction of Bellefonte Unit 1 included:

- A review, assessment, and validation of the estimate to complete the Bellefonte original design, as identified and quantified in the 1994 Definitive Estimate.
- Identification of equipment and systems impacted by Investment Recovery activities and generation of estimates to repair or replace this equipment.
- Development of a site Facilities Plan and a cost estimate to implement this plan.
- Generation of an estimate to repair or refurbish plant components affected by aging, plant environment, or deferral of preventive maintenance issues.
- Obtaining estimates for major work to be performed through services contracts (steam generator fabrication and installation, Turbine/Generator (T/G) refurbishment, cooling tower upgrades, etc.).
- Evaluating and estimating additional work and/or upgrades identified by additional engineering reviews performed as part of DSEP.

The Engineering Reviews performed during the DSEP were used as inputs to develop construction estimates. These reports were reviewed and, where necessary, estimates were prepared for the construction effort associated with work identified in the reports.

The scope of the construction work generally falls into one of the following categories:

- Remaining work to complete the original construction (from 1994 Definitive Estimate).
- Construction and/or renovation of plant facilities.
- Repair/Replacement of Investment Recovery affected equipment and components.
- Repair/Replacement of components affected by aging or impacts from the plant environment.
- Other items identified, such as plant upgrades that do not fall into one of the above categories (e.g., new regulations, GSI-191, 10CFR Part 73).

These categories are further discussed below.

Remaining to-go Estimate

The estimate is a detailed bottom-up estimate prepared and refined over a period of two years (circa 1992 to 1994). It was supported by and based on detailed plant walkdowns and included validation of existing design documentation and construction records. It also included resolution of known project issues, closure of open items, and plant and project staffing.

For the DSEP effort, activities in the Definitive Estimate were reviewed and validated, to the extent practical, as complete and accurate. Based on the detail contained in this estimate, and the fact that it was the product of "hand over hand" walkdowns generated by personnel working directly on the plant who were intimately familiar with plant status and issues, it was determined that this estimate could be accepted and used as the base estimate for the remaining construction "to-go" scope estimate, with the costs updated to reflect current productivity assumptions in 2009 dollars.

During the DSEP effort, additional items and cost were added to the estimate. These items were reviewed for possible duplication of activities that may have been included in the Definitive Estimate. Adjustments, either upward or downward, were made based on the costs contained in the Definitive Estimate. Additional items not addressed in the Definitive Estimate were added to other categories described below.

Facilities Plan and Construction

A review of plant facility needs was conducted as part of the DSEP, and a complete Facility Plan was developed. BLN DSEP and Nuclear Power Group (NPG) management identified facility needs based on today's operating plant requirements and projected construction needs. Current TVA operating plant facilities and new nuclear plant construction projects were used as benchmarks.

TVA's Facility Planning organization obtained and provided cost estimates for new facility construction and existing building renovation, with schedules necessary to support the current construction schedule.

All new and existing facilities will be constructed or modified in accordance with TVA Standard Programs and Processes (SPPs), specifically SPP-3.2, Internal Energy Efficiency Process, and SPP-3.3, Resource Efficient Building Design Process. Facility work will also be aimed at gaining LEED Gold certification for the site.

1. All new structures will be oriented to take advantage of passive solar energy and daylighting where feasible.
2. Parking lots, roads, and building materials will incorporate Coal Combustion Products (CCPs) and recycled content wherever possible/feasible.
3. Utilize low-emissive roof materials to minimize heat gain and heat island effect.
4. Incorporate energy efficient lighting systems with occupancy sensor controls.
5. Incorporate task lighting where feasible.
6. Incorporate HVAC systems with high efficiency systems.
7. Incorporate plumbing fixtures with low-flow flush type fixtures.
8. Use energy efficient low-E glazing units.
9. Reuse storm water runoff for landscape irrigation and other non-potable uses.
10. Implement electric vehicle use and provide solar powered recharging stations.
11. Encourage the use of Low Emission Vehicles (LEVs) by providing preferred parking for employees driving hybrid, electric, or other "green" transportation.
12. Utilize high thermal value insulation systems to minimize building heat gain/loss.

Facilities are planned to be constructed/renovated using contractors separate from the plant construction contractors.

Investment Recovery

Following termination of the Bellefonte Construction Permit in 2005, TVA implemented an Investment Recovery effort to recover costs associated with the asset at Bellefonte. Some equipment was sold and removed from the plant as part of this effort. Additionally, some usable components were transferred from Bellefonte to other TVA facilities as spares or needed parts.

The Investment Recovery effort removed all or parts of some major plant components, including steam generators, feedwater heaters, large pumps and motors, demineralized water and condensate storage tanks, main condenser tubes, and some piping and valves on Elevation 629 of the Auxiliary and Turbine Buildings, and in safety-related pipe chases.

In 2008, Sargent & Lundy was contracted to identify and document the configuration of plant equipment affected by the Investment Recovery effort. This review included detailed plant walkdowns and marking of drawings and plant equipment to document status of plant equipment. This information was used to determine material/component quantities needed to develop the completion costs.

Equipment affected by the Investment Recovery effort was identified, and cost estimates were developed for the construction resources required to reinstall or replace these components. Many of the components affected will be replaced through the use of services or specialty sub-contracts. Other components/equipment will be installed by the prime construction contractor.

Table 2-1 shows major items/components that were affected by the IR effort and their estimated replacement cost.

Table 2-1. Major Plant Components Removed by IR ($ x Million)

COMPONENT	REPLACEMENT COST ($M)
Control Rod Drive Mechanisms Including Service Structure/Cables	$41.9
Replace Inventory	$31.9
Pumps and Motors	$17.2
Steam Generator Material/Installation Contract	$229.6
Feedwater System (CF)	$4.9
Condensers (CC)	$14.8
Condensate, Demineralized Water and Lube Oil Storage Tanks	$1.6
Auxiliary Boiler and Building	$3.6
Investment Recovery - Piping and Electrical	$33.6
Investment Recovery – Other	$10.6
TOTAL	$389.7

Equipment Repair and Refurbishment

Bellefonte has been dormant for over 20 years, and nearly all active components will require inspection and refurbishment or replacement in order to be restored to a condition that enables them to meet performance and design requirements. Aging and environment issues must be evaluated and addressed prior to obtaining an operating license for Bellefonte.

In some cases, replacement of the component will be more cost-effective than inspection and refurbishment. As part of the DSEP engineering reviews, studies were performed on major plant components (pumps, valves, motors, breakers, and transformers) to identify condition of the components and to evaluate whether the components should be replaced or refurbished. Additionally, repairs to items such as plant protective coating were identified as being required due to age-related deterioration of their condition. These DSEP reports were evaluated and construction costs associated with refurbishment/replacement of equipment potentially affected by aging or environmental conditions were estimated and added to the DSEP cost estimate.

Additional Scope/Plant Upgrades

Additional items were identified as part of the DSEP reviews. These items included recommended plant upgrades, new scope items, items affected by current regulations, and other items not falling into the above described categories.

The DSEP project estimate also has approximately $25 million for critical spare parts that are not identifiable at this time. Critical spare parts that could be identified are included in the estimate associated with the applicable Work Breakdown Structure (WBS) for the specific system(s).

Additional engineering scope/plant upgrade items were reviewed and evaluated for the associated construction completion scope. These items were identified by DSEP engineering reviews and/or the 1997 and 2008 Bellefonte cost updates. Where construction activities are necessary, an estimate was developed and included in the DSEP costs.

Significant items classified as additional scope included:

- Seismic issues resulting from design changes.
- Digital I&C upgrades.
- Security system design and installation.
- Proposed system modifications from DSEP Engineering Reviews.
- Switchyard upgrades.
- Cooling tower upgrades.
- Alloy 600 issues.
- Containment Sump Modifications.

Lessons Learned

The BFN Unit 1 project and the WBN2 project, while being executed well, have provided a number of lessons learned that Bellefonte will take action on to ensure those lessons are not repeated. Applicable lessons learned are listed below.

Contracting Plan:

- Effective planning is needed for work management at the work package level. Bundling work and planning for that bundling will make work much more efficient and reduce unit rates. Supporting this effort will be development of procedures and processes as well as contractor preparation to support.
- Planning ahead, including in contracts, will ensure the various vendors will work together well. Processes and support such as scaffolding, temp power, coatings and insulation are TVA processes, and everyone will be required to follow them. Bellefonte will develop a detailed plan for proper contractor reporting procedures.
- Contractors must understand (and where applicable build into contracts) that they will follow TVA reporting standards. The project team will determine early what is needed in terms of reporting. For example, the team will determine the Performance Indicators (PIs) early for areas like Engineering, Licensing, Package Preparation, and Materials. This effort will include consideration for how earned value is reported, validated, and paid.
- Bellefonte will be extremely clear on scope with each of the major vendors. This will prevent difficulties with agreements on who owns what scope.
- One lesson learned is to identify groups of valves early both through design and procurement. This will enable Bellefonte to bundle valves and purchase contracts, which will ensure better response from vendors and lower costs.

Quality Assurance:

- The project team will evaluate head counts needed in number of QC inspectors to ensure there are no delays in project execution due to this resource.
- A detailed process for walkdowns needs to be developed with lessons learned from WBN, including getting QC involved with the walkdown process.
- Bellefonte will be using the DSEP report throughout the project to ensure that the schedule and planning is adhered to.
- Clear alignment and coordination of design changes are necessary as part of NPG business initiatives to improve performance and plant reliability. Bellefonte will conduct reviews with NPG as the customer as final scoping work is completed.

General:

- The team is evaluating offsite fabrication for items such as piping and hangers – it is much more expensive and slower to field build.
- The team is evaluating setting up wireless throughout the plant, but also permanently throughout containment.

2.3 Startup Methodology

Activities associated with and required for transfer, testing, and startup of the Bellefonte plant were identified, estimated, and included in the overall cost estimate. These activities included:

- Construction integrity testing.
- Transfer of systems from construction contractors to NGDC.
- Preparation and performance of Preoperational Tests.
- Development and performance of Power Ascension Tests.
- Preparation of operating procedures (Maintenance and Operations procedures).
- Operations support for construction and testing activities.

WBN2 was used as a model for performing these startup activities while estimating costs for Bellefonte. In addition, future benchmarking of original startup testing will be performed at operating B&W plants.

Construction contractors will perform construction integrity testing prior to transfer of the system to the TVA Startup organization. Estimated costs for the performance of these activities have been included in the BLN cost estimate.

A TVA NGDC Startup organization has been established to coordinate transfer of systems from Construction contractors to TVA, and to develop and perform Preoperational tests in accordance with Regulatory Guide 1.68. Staffing levels of this group have been estimated and are sufficient to perform these activities. Site Engineering personnel are also expected to participate in the performance of this testing.

The Power Ascension Testing program procedures will be developed and performed by Site Engineering personnel following completion of the preoperational testing program and receipt of an NRC Operating License. Staffing levels of the Site Engineering organization are sufficient to perform these activities. Preoperational test personnel will also participate in power ascension testing as required.

Other activities required to support startup of the plant include:

- Operations support of construction and testing
- Preparation of Operating procedures/instructions for plant operation
- Maintenance of transferred systems
- Preparation of Maintenance procedures/instructions for plant operation
- Development and establishment of operating plant programs
- Training and certification of operating personnel

These activities will be performed as level of effort activities performed by project and permanent plant staff personnel. Detailed staffing studies were performed during the DSEP, resulting in estimated staffing levels required to perform these and other activities during the

construction and startup of Bellefonte. Resources for these staffing levels were included in the overall BLN consolidated cost estimate.

2.4 Estimating/Cost/Schedule Methodology

Estimating System

The consolidated estimate for the completion of Bellefonte Unit 1 has been developed using multiple sources of information and captured in an Access/Excel data base and coded to the specific system Work Breakdown Structure (WBS).

Estimate Components

The following components were used as an integrated resource for developing the consolidated estimate:

- Engineering source documents for studies generated during the DSEP process. Over 70 studies were completed during the DSEP Project, and estimates were performed based on the recommendations by the different engineering companies that participated.
- Historical information from previous studies, including the Definitive Estimate that was generated in the 1992 to 1994 timeframe.
- A 1997 study for a proposal for Bellefonte to generate Tritium for the DOE/DOD. Recommendations were validated or removed.
- A 2008 study that was completed by TVA staff with the assistance of AREVA. Based on this study, additions were validated or removed from the estimate totals.
- Detail take-offs for material and equipment that was removed from the plant during an investment recovery effort in the 2005 to 2007 timeframe.
- Commodity pricing was developed by using vendor quotes, TVA blanket pricing, and other data from projects that had existing recent data.
- Allowances were made on a high-level basis for spare parts that were removed during the Investment Recovery period of 2005 to 2007, and $25 million is included in the estimate for critical spare parts.
- The unit rates from the 1994 Definitive Estimate were used along with the commodity quantities to develop to-go costs which, in turn, were escalated to the present. WBN2 unit rates were used for investment recovery, replacements, upgrades, and other DSEP scope items.
- The composite wage rate used for BLN is $38.35/hour, which includes fringes, taxes, and allowance (2%) for Foreman and General Foreman. Overtime was applied at 25% (assuming 5-10s work schedule), which resulted in a composite rate of $42.20/hour. Costs for any potential retention or per diem are not included in this rate.

- The construction distributable hours were determined by applying 32% of the direct craft to-go hours. The distributable craft wage rate was calculated to be $35.58 based on an estimated craft mix for the scope of the BLN work. Construction distributable material costs were calculated at $8.00 per direct craft hour.
- Field Non-Manual (FNM) hours for the constructor (excluding NSSS and Digital Upgrade scope) were developed based on the staff required to prepare work packages, provide craft supervision, and provide construction management services.
- Subcontract costs were developed based on budget quotes, where sufficient scope was available, and utilization of comparable program data otherwise.
- Startup hours are based on the Definitive Estimate of 1994 for staffing plans by position at that time and adjusted to reflect additional scope.
- Start-up support and materials were used from the 1994 Definitive Estimate and escalated to 2009 dollars; comparison to other facilities was done to ensure reasonableness.
- Engineering estimates were derived from the study reports done during the DSEP Project, the 1994 Definitive Estimate, and additional scope reviews completed.
- Oversight hours were derived from the 1994 Definitive Estimate, the 1997 report, and the 2008 report and summarized.
- Escalation was derived from a combination of TVA rates and recent Bureau of Labor Statistics (BLS) rates.
- A risk review was performed, a risk register generated, and contingency dollars assigned. Risk is discussed in more detail in other portions of this report.
- Freight was estimated using historical numbers used in the MII estimating software.
- Contractor fees are included in specific contracts that are in negotiation. Fees for direct construction work will be set at 10% in the estimate (5% base, 5% incentive); engineering for NSSS at 15% (7% base, 8% at risk); and Balance of Plant at 10% (5% base, 5% at risk).

Schedule Methodology

The Project Schedule was developed using the Primavera P-3 scheduling program beginning with the Start-up/Test schedule working backwards. The individual schedule components were developed based on:

- The Start-up schedule was derived from the historical start-up sequence from the 1994 plan and reviewed by the Operations group for correct sequencing. System start-up activities for systems that were previously turned over in the 1992 timeframe were added back in due to the necessity to retest all systems. Sequence reviews were done by the Operations staff and Project Controls to have the basis for the project Level II schedule.
- The project scope was loaded into the WBS, and the schedule for the engineering, construction, and testing activities was put into a level II format by system turnover.

Durations were set based on resource loading the activities per the WBS using average crew sizes. Building turnovers are considered a system at Bellefonte and were scheduled accordingly.

- Detailed fragnets were developed for future use for the Engineering Studies performed during the DSEP project. These fragnets are available to be loaded into the schedule for detailed schedule work later on in the project.
- Additional Level 2/3 schedule detail is being developed for the first 12 to 18 months after project approval. This will be an ongoing process until the definitive estimate is finalized after the system walkdown program is completed.
- Resource leveling was performed to level out the resources for funding requirements verification and checking for validity of the maximum resources required during any specific timeframe.

2.5 Assumptions and Qualifications

General

Contract awards would follow a TVA Board authorization to resume completion of Bellefonte Unit 1.

The work week is a standard 40 hours for all personnel, based on a 4-10s schedule. Depending on what other construction projects are occurring in the Southeast U.S., a 5-10s work week may be required to attract experienced craft personnel. The estimate includes dollars to support a 5-10s work week.

Current embeds and structures are acceptable as is, except those identified for Steam Generator/Reactor Coolant piping removal and re-installation.

Existing plant material is good "as is" for plant completion except materials identified in the DSEP reports and Investment Recovery removed items. Items found during final system walkdowns will be covered by general contingency.

Existing cable was considered to be acceptable "as is" except those identified by DSEP reports, those under water that will be replaced, or those damaged by the Investment Recovery efforts. Engineering will develop a testing procedure to verify that the existing cables are acceptable to meet system requirements.

The ASME code of record is the summer 1974 edition.

Field Services and Engineering

Field Services and Engineering assignments will be included in the specific contracts for those services. Any funding for retention plans was not included at this time.

Startup

The Startup Organization will consist of both TVA Operations personnel and TVA Field Engineering personnel who will transition to system engineers at time of plant operations.

- TVA will hire and train new Operator personnel for Bellefonte Unit 1, and they will be included in the overall staffing plan.
- TVA will hire and train new Maintenance personnel for Bellefonte Unit 1. Contractor craft will supplement this group for equipment preventive maintenance until the personnel are trained and systems are turned over to the plant personnel.
- NSSS and Turbine Generator Technical Advisors costs are included within the NSSS and Turbine Generator estimates.

2.6 WBN 2 Scope and Results Comparison

The BLN DSEP team reviewed previous DSEP studies performed for WBN2 and the BFN1 Restart. The WBN2 project shared more commonalities with the BLN project, and the BLN DSEP team evaluated both the similarities and the lessons learned from WBN2. Table 2-2 provides a high-level comparison.

Although there are similarities shared with WBN2 and the BFN1 restart, the BLN completion effort involves unique differences, which cause cost differences that the other two plants did not incur. For example, WBN2 has an operational Unit 1 on site and was able to model much of the Unit 2 completion on its companion unit. The BFN Plant had been operational for some time before temporarily ceasing operation, and its facilities had been fully designed, constructed, and maintained throughout the period of shutdown. The BLN Unit 1 completion effort also includes replacing equipment that was not fully maintained or was subject to the Investment Recovery effort.

Table 2-2. Comparison of BLN Completion to BFN Restart and WBN2

AREA	BFN1 RESTART	WBN2	BLN COMPLETION
Engineering Approach	• Design complete. • Incorp U2/3 Mods • Issue Design Baseline Documentation	• Design complete. • Incorp U1 Mods • Issue Design Baseline Documentations • Address aging issues	• Design Incomplete • Address issues since 1988 • Perform Design Baseline • Address aging issues • Proposed plant upgrades/improvements
Licensing	• U1 licensed to operate	• U1 licensed to operate • U2 Construction Permit in place	• Not licensed • No licensed model (FOAK issues)
QA Program	• Fully functional programs • ASME Section XI, Repair and Replacement	• Fully functional programs • ASME Section 3 (Supports not included)	• Must re-establish programs & procedures • ASME Section 3 Review (Supports included)
Site Security/ Physical Barriers	• In place	• In place	• No permanent infrastructure exists or is designed
Plant Facilities	• Existing plant facilities • Eng facility • 2nd Simulator	• Existing plant facilities	• Major new construction & renovation • New training facility
Inventory	• Existing inventory • Some inventory increases needed	• Existing inventory • Some inventory increases needed	• Inventory and spares were sold – must procure replacements
Investment Recovery (IR)	• No IR activities • Replace scavenged equip	• No IR activities • Replace scavenged equip for U1	• Replace significant amount of IR equipment (steam generators, RC pump motors, etc.)
Plant Staffing	• Incremental staffing to support Unit 1	• Incremental staffing to support Unit 2	• Full staffing of Plant (NPG) organization
Safety Analysis and Fuel Design	• Existing	• Existing	• New and unique for BLN
Construction	• Construction complete • Refurb & Update programs	• Construction completion from ~60% complete • Interfaces with Operating Unit	• Construction completion from ~55% • S/G replacement • D/G refurb • Significant IR work

2.7 Licensing Methodology

The licensing effort for BLN includes the following major areas:

- Development of regulatory baseline and outline of critical submittals, including the superstructure of the Regulatory Framework.
- Full development of critical submittals and the subsequent submittal of those identified as significant in establishing the licensing baseline. This second phase includes the development and submittal of a letter to NRC notifying them of TVA's intention to reactivate construction of BLN, consistent with the information provided in NRC Generic Letter 87-15.
- The major licensing effort is the development, submittal, and implementation of deliverables necessary to support the NRC issuance of the licenses required to complete and operate the plant. These include reconstitution of the Final Safety Analysis Report (FSAR) and Technical Specifications, interactions with the NRC to resolve elements of critical submittals, and resolution of any admitted contentions.

2.7.1 Outlining the Licensing Baseline for BLN

The major deliverable of this phase is the regulatory baseline and development of a regulatory strategy for significant licensing issues. The baseline represents the superstructure of the Regulatory Framework and will be the basis of the future submittals to NRC. The effort to develop this baseline will include:

- A determination of key assumptions, which will be incorporated into a key assumptions letter to the NRC.
- An evaluation of requirements and guidance, including a review of the 1981 issue of NUREG 0800 versus the 2007 revision of NUREG 0800 to identify changes in regulatory requirements and guidance.
- An evaluation of prior issues (previously identified by Bellefonte Position Papers) to determine the need to identify them as key licensing issues.
- A determination of applicability and status of generic communications relative to BLN.
- A review of FSAR chapters to determine contents with respect to the above issues and the impact of the evaluation of these issues on future FSAR amendments.
- This phase will also include the development of a regulatory approach to significant licensing issues (I&C, Seismic, Fire Protection, etc.) in advance of the full license application update.

2.7.2 Full Development of Licensing Baseline Including Construction Reactivation Request

The second phase of the licensing effort will include fully defining the regulatory framework in preparation for construction reactivation. Additionally, critical licensing submittals will be developed and several of the longer term licensing tasks will be initiated.

- Construction Reactivation Letter – providing the information normally submitted by a licensee prior to reactivation of construction in accordance with Generic Letter 87-15, NRC's Policy Statement on Deferred Plants.
- Refurbishment – Pre-Service Equipment Condition Management Program.
- Nuclear QA Plan Update.
- Development of a Baseline FSAR.
- Support of the Development of a PRA – work will be initiated on the development of a PRA, which will address Individual Plant Evaluation (IPE), Individual Plant Evaluation for External Events (IPEEE), and Severe Accident Mitigation Design Alternatives (SAMDA).
- Development of additional submittals required for operating license application.
- NRC Inspection History Re-constitution – Licensing will review NRC inspection reports for BLN to provide an accurate database of the inspections and any findings and violations.

2.7.3 Updated NRC Operating License Application

The updated Operating License application will include a set of submittals for licenses under 10 CFR 30, 10 CFR 40, 10 CFR 50, and 10 CFR 70. The submittals will address the required elements for each license and will occur concurrent with Engineering progress. In addition to the submittals, Licensing will interface with NRC in the conduct of their inspections and the resolution of any findings and violations.

2.7.4 Open Item Management

The majority of the effort after the activities that support the Operating License application will involve closure of the various categories of issues associated with obtaining the license (commitments, generic communications, historical position papers, Operating Experience, and BLN specific issues, etc.).

Finally, near project completion, Licensing will be required to support potential regulatory, industry, and TVA oversight activities. In addition, Licensing will be involved in legal issues at the federal (ASLB, as an example) and state levels, as well as potential contentions.

In conclusion, the scope and resources required to perform licensing activities have been identified, and the cost and schedule estimates reflect licensing needs.

3 PROJECT EXECUTION

A high-level execution strategy has been prepared as part of the DSEP effort. This strategy:

- Describes the major phases of the project.
- Identifies key functions and responsibilities (TVA vs. Contractors).
- Provides general guidance on use of Quality Assurance (QA) Programs and procedures.
- Identifies contracting model for plant completion.
- Describes strategy and infrastructure planned to implement and manage key QA programs.

The following sections summarize the plan for completion of Bellefonte Unit 1. The complete version is contained in the Project Execution Strategy.

3.1 Engineering

Site Engineering is responsible for the scope and performance of engineering tasks necessary to complete Bellefonte. Site Engineering will also be responsible for the management and oversight of engineering firms contracted to furnish engineering design services.

It is the intent to issue contracts for engineering services to two engineering firms. One is expected to be the Nuclear Steam Supply System (NSSS) supplier for nuclear safety related design and the other for the Balance of Plant (BOP) Design. The Site Engineering group will establish processes, procedures, and quality requirements necessary for control and consistency of output from the engineering services contractors.

Engineering activities will begin following project approval, with services contracts issued and detailed engineering expected to commence within six months of project approval.

The initial focus of engineering will be identification and documentation of plant licensing design basis, development and issue of design output, and establishment of specific program requirements, such as ASME Section III and Environmental Qualification (EQ) programs. It is expected that a majority of the engineering will be complete in 30 months. The schedule reflects the assumption that bulk plant construction could start in mid-2012.

Engineering will support construction during installation and startup activities, and provide technical support for the Preoperational and Power Ascension test programs. Interfaces with the construction organization will include resolution of installation issues, disposition of field change requests, and resolution of test deficiencies.

Following plant completion, it is expected that Site Engineering personnel will be involved in the required engineering support for the operating plant, including plant system engineers and issuance of plant modification designs.

3.2 Supply Chain (Procurement and Materials Management)

The BLN Project Supply Chain organization is responsible for the scope and performance of supply chain tasks necessary to complete Bellefonte. This organization will establish supply chain policies, procedures, and systems/applications for procurement of equipment and materials for BLN. Engineering contractors will have responsibility for development of design procurement specifications and performance of the procurement engineering function.

Portions of the procurement process may be delegated to the engineering and/or construction contractors (such as warehousing activities) as part of their contract. Those with delegated procurement authority will be required to follow TVA procurement processes and procedures.

Materials management activities will be the responsibility of and will generally be performed by TVA, with any delegations or exceptions specifically included in the appropriate contract.

For fixed price and managed task contracts (such as Turbine-Generator refurbishment, Steam generator installation, facility construction/renovation, etc.), equipment procurements will be handled by the contractor using their processes and quality programs (if required) as part of the awarded contract.

3.3 Construction

The Bellefonte Construction organization is responsible for planning and integrating the scope of construction necessary to complete Bellefonte. This organization will also be responsible for the management, support, and oversight of construction firms contracted to furnish plant construction services.

It is the intent to issue contracts for construction services to two construction firms. Generally, one major scope is expected to be the construction activities in the Reactor, Control, Auxiliary, and Diesel Generator Buildings, and the other major scope will be for the Balance of Plant (BOP) construction in the Turbine Building. The BLN Construction organization will establish and/or approve work control processes used by construction contractors in order to provide control, consistency, and quality of contractor performance work. The Construction organization will also interface between construction contractors where required.

Significant facility construction/renovation is required for Bellefonte. It is the intent to issue contracts separate from the plant construction contracts to complete this work. These contracts will be awarded and managed by the BLN Construction organization through TVA's Facilities Group. BLN Construction will provide support and oversight of the facilities contractors while on the Bellefonte site.

Initial construction planning and facilities construction/renovation will commence following project approval in order to support a resumption of plant construction activities. Construction activities are scheduled to resume approximately 12 months after project approval.

The construction project schedule was developed using the Preoperational test program requirements as the base schedule. Construction work packages will be identified, completed, and transferred to support the Preoperational test schedule. In turn, detailed engineering completion and procurement will be scheduled to support construction and transfer requirements.

3.4 Startup

Startup of Bellefonte will be accomplished in accordance with Regulatory Guide 1.68, Initial Tests Programs for Water-Cooled Nuclear Power Plants. This Regulatory Guide addresses Construction, Preoperational, and Power Ascension testing required to demonstrate the completion and performance of the integrated plant and systems.

The base construction schedule has been developed to support the transfer and integrated preoperational testing of plant systems. The schedule has been developed to allow sufficient time and resources for transfer of systems. Consideration is given to the number of system turnovers per month to ensure turnovers and testing are leveled and manageable.

Bellefonte completion and startup activities will include:

- Construction integrity testing.
- Transfer of completed systems.
- Preoperational Testing.
- Power Ascension Testing.

Planning and scoping of the detailed test program requirements, development of test logic, and development of Startup administrative procedures will commence following project approval in order that detailed construction planning can proceed. A Startup Manager will be named early in the project to direct these activities.

Construction contractors will be responsible for completion of construction testing as specified in RG 1.68, including cleaning, flushing, and other component integrity testing. Following system completion and testing, the system will be transferred to the TVA Startup organization for performance of integrated Preoperational tests.

The Startup organization will be composed of TVA and/or contract personnel. Startup will accept systems from the construction contractors and perform integrated system testing. At system transfer, ownership and maintenance of the system/component will become the responsibility of the TVA NGDC organization.

BLN NGDC project personnel will be responsible for operation and maintenance of plant systems until completion of preoperational testing and turnover of systems to the NPG operating organization. This turnover is planned before receipt of the Operating License (OL) and Initial Fuel Load.

Following completion of preoperational testing and receipt of the OL from the NRC, the Power Ascension Testing will be performed under the direction of the NPG organization. System Engineering personnel will take the lead in developing and performing Power Ascension Testing. Personnel from the Preoperational Test Program will support this testing as required.

In parallel with completion, turnover, and preoperational testing of plant systems, plant programs, and procedures required to support plant operation will be developed and established by the NPG operating organization.

3.5 Owner

NGDC will provide overall project management for the completion of BLN1. The TVA management team will be located on site and will provide day-to-day management and support to the project.

4 SCHEDULE

4.1 Key Dates

Reference Appendix A for detailed schedules. The table below shows key assumed dates.

Table 4-1. Key Milestones for a 90-Month Schedule.

MILESTONE EVENT	90-MONTH SCHEDULE
TVA Board Decision (proposed)	August 2010
Contract Award NSSS	September 2010
Contract Award Balance of Plant Engineering and Procurement Services	September 2010
Engineering Work Start	October 2010
Construction Start	July 2012
Delivery of Simulator	February 2014
Cold Hydro Testing	August 2016
Hot Functional Testing	November 2016
Receive Operating License / Start Fuel Loading	February 2017
Initial Synchronization to Grid	May 2017
Commercial Operation	October 2017

NOTE: The 90-Month Schedule is shown. The 96-Month Schedule is based on potential risk and would extend the Commercial Operation start date by 6 months. Most of the previous milestones would not be affected.

4.2 Critical Path

The primary and secondary critical paths are identified in the BLN schedule as follows:

- The primary critical path is through the engineering design of the Instruments and Controls (I&C) platform sufficient to allow construction and certification of the training simulator, ultimately allowing for the completion of licensed operator training to support fuel load and plant start-up.
- The secondary critical path is through fabrication and installation of replacement steam generators. Early forging slot reservation and fabricator selection has enabled the project schedule impact of steam generator procurement to be reduced from 80 months to 62 months. Plant completion activities following installation of steam generators currently shows approximately 6 months of schedule float.

The primary and secondary critical paths will be further refined as more engineering and construction planning data becomes available. Other near-critical paths may be identified as additional information becomes available and risk mitigation measures are implemented. The paths currently defined tie to the start of Cold Hydro.

The major milestones for the project are shown in Table 4-1 above. A more comprehensive depiction is in the current Level 1 Schedule, which is included in Appendix A.

Project Completion Level 1 and Level 2 schedules are being maintained and organized to the latest approved WBS. The Project Controls department ensures that the planners and schedulers have the latest approved WBS or scope to be included in their process. Level 3 and more detailed schedules maintained in the WBS will be at the discretion of the Project Manager; however, the single point of approval for any WBS addition or deletion is the Project Controls Manager. Schedules generated by the contractors must support the TVA Level 2 master schedule milestones to support the System Turnover sequence developed by the Bellefonte project team.

4.3 Startup

The Bellefonte Startup schedule was developed using the 1994 Definitive Estimate report schedule and adding the systems not identified in that document that were already turned over to plant operations. All turnover packages will be returned to the construction organization for review and replacement /repairs required.

5 ESTIMATE

5.1 Overview

The Bellefonte Consolidated Estimate is based on the information available at this time. The cost estimate is based on an interdependent system of TVA cost and budgeting data, current economical conditions, the project WBS, projected labor, schedule requirements, regulatory requirements, equipment cost, and risk considerations.

The DSEP team has weighed past and present data in order to develop an accurate, reliable, and meaningful cost estimate based on the information available. A definitive estimate will be forthcoming as more detailed engineering information becomes available.

5.2 Quantities

Civil quantities are primarily limited to the work required to complete containment access work and modifications required to remove the existing steam generator shells and replace them with two new steam generators. These costs are included in the reactor coolant system construction activities and steam generator replacement estimates submitted.

Mechanical commodities are primarily pumps, piping, and pipe hangers and snubbers that were not previously installed or replacement required due to the Investment Recovery activities. The pump, motor, and valve programs that were reviewed and estimated during the DSEP Project were estimated in subcontract format, since these items could be worked by specialty contractors if necessary.

Electrical commodities came from the 1994 Definitive Estimate to complete, engineering DSEP reports, and detailed takeoffs from drawings for items that were removed during Investment Recovery. Pricing for equipment was developed utilizing TVA pricing information, engineering report recommendations, and vendor quotes for refurbishment and replacements.

5.3 Pricing

Pricing for commodities was based on to-go quantities identified in the 1994 Definitive Estimate report, DSEP Engineering Reports, reviews of Browns Ferry actual, WBN2 actual costs, TVA current pricing, and escalation to 2009 dollars.

Pricing for subcontract activities was based on budgetary quotes as applicable for programs identified by DSEP engineering reports and vendor quotes for services. The estimators compared work activities at BFN projects to WBN2 projects to ensure fidelity in the numbers.

For Steam Generator Replacement and Turbine Generator inspection and refurbishment, vendor quotes were reviewed and used.

Pricing for equipment was developed using TVA pricing information and budget quotes from vendors as applicable.

5.4 Engineering

An engineering rate of $89/hr was used for all engineering hours added during the DSEP Project additional engineering studies. This is consistent with the Watts Bar engineering composite rate.

5.5 Field Non-Manual / Startup

Field Non-Manual (FNM) labor was based on the staffing required by the Constructor to support the direct craft labor (approximately 12,989,000 hours) for the BOP work, excluding NSSS and Digital I&C work. The scope of the Constructor's FNM staff will, in general, prepare cost and schedule information, provide procurement services, provide craft oversight/supervision, prepare work packages, and perform management services. QC services for this scope of work will be provided by TVA. Approximately $143 million is included in the estimate for this work scope.

Startup hours were identified in the 1994 Definitive Estimate and escalated to 2009 dollars. Approximately $59 million is included in the estimate for this work scope.

5.6 Wage Rates, Unit Rates, and Productivity

The composite wage rate was calculated by applying the applicable wages from the TVA Project Agreement wage bulletins to the corresponding direct craft hours for the to-go work. The total direct craft cost for the to-go work was divided by the total direct craft hours to determine the composite wage rate. The resulting composite wage rate for BLN1 is $38.35/hour, which includes fringes, taxes, and allowance (2%) for Foreman and General Foreman. Overtime was applied at 25% (assuming 5-10s work schedule), which resulted in a composite rate of $42.20/hour. Costs for any potential retention or per diem are not included in this rate.

The unit rates from the 1994 Definitive Estimate were used along with the commodity quantities to develop to-go costs which, in turn, were escalated to the present. A sampling of these unit rates were compared to the unit rates currently being used at WBN2. The comparison showed general agreement considering escalation and the work environment expected at BLN1. For Investment Recovery, replacement, upgrades, and other DSEP scope items, the unit rates and productivity factors for the WBN2 Completion Project were used where estimating for commodity installation was performed. Other sources of productivity rates were used, such as "RS Means", where those rates were applicable and a corresponding WBN2 rate was not available.

5.7 Distributables

The construction distributable hours were determined by applying 32% of the direct craft to-go hours. The distributable craft wage rate was calculated to be $35.58 based on an estimated craft mix for the scope of the BLN1 work.

Construction distributable material cost was calculated at $8.00 per direct craft hour, using WBN2 data.

5.8 Other Costs

Some allocations for travel and training are in the consolidated estimate, using current rates.

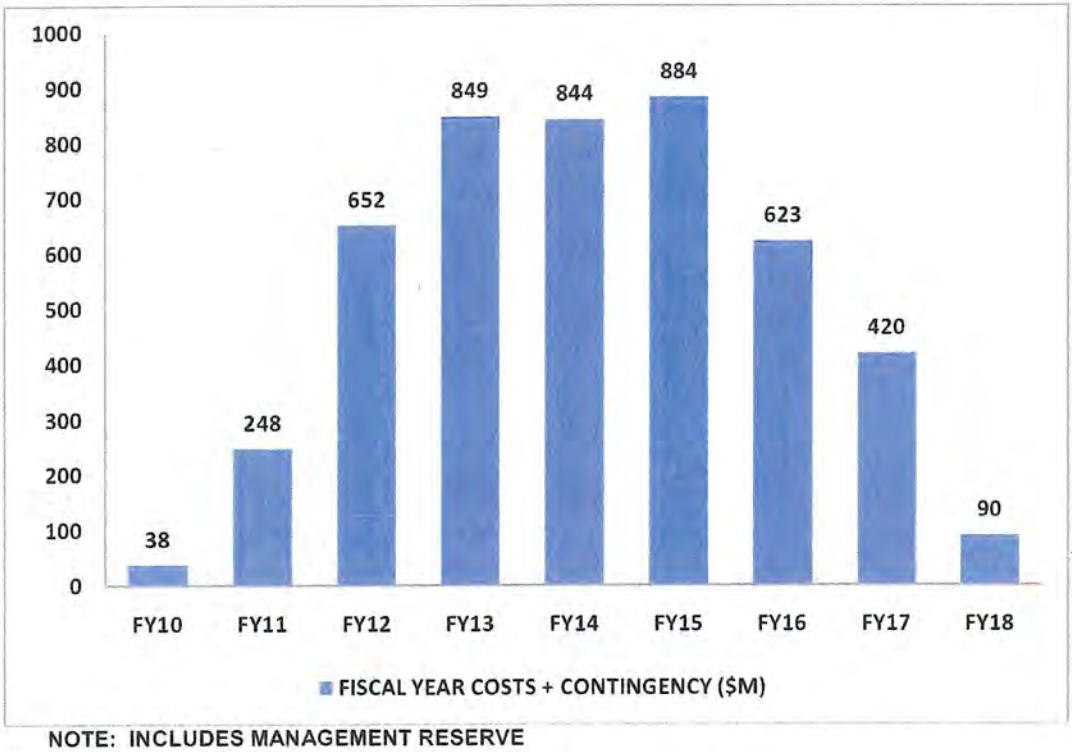
Contractor fees are included in specific contracts that are in negotiation. Fees for direct construction work are expected to be set at 10%.

5.9 Escalation

The escalation calculation used escalation rates provided by TVA and the Bureau of Labor Statistics (BLS), which adjusted the calculations to account for some negative escalation numbers for commodities between 2008 and 2009.

5.10 Estimated Project Cost

The assignment of resources from the estimate to scheduled activities (that accomplish the WBS scope) produces a Performance Measurement Baseline (PMB), which is a time-phased plan. The PMB is shown in Figure 5-1 as Fiscal Year Costs through FY18.



NOTE: INCLUDES MANAGEMENT RESERVE

Figure 5-1. BLN Unit 1 Estimated Cost (in 2009 Dollars)

5.11 Contingency/Allowances

Contingency for the completion of Bellefonte was developed by reviewing both the project Risk Register and the results of the Huron Consulting Group (Huron) cost and schedule risk analysis (described in Sections 5.12 and 5.13), and then assigning contingency to cover unknowns. The contingency is $500 million.

5.12 Risk Identification and Evaluation

BLN project-level risk reviews and management activities were conducted in conformance with TVA SPPs for Project Risk Management, such as Procedure 33.02, and the BLN Project Risk Management Plan (BLN-PC07-001). Methodologies used are also consistent with the Project Management Institute's Project Management Body of Knowledge (PMBOK) guidelines for project risk management.

Effective risk management is critical to the success of the overall TVA Nuclear Generation Development and Construction program, as well as the BLN project. Accordingly, a parallel and independent risk analysis was performed by the Huron Consulting Group (Huron). Huron was retained to assist TVA in identifying and evaluating risks and their unmitigated cost and schedule impact associated with completing Units 1 and 2 versus completing Units 3 and 4 (the newly designed AP1000 facility). The scope of the Huron assessment included risks outside of the control of the BLN project that are assessed and managed at the corporate level.

BLN project risk reviews and management activities included the processes concerned with conducting risk planning, identification, analysis, response, and monitoring on the project. The objectives of project risk management are to increase the probability and impact of positive events, and decrease the probability and impact of events adverse to the project. The relationships between the key processes used for BLN risk management are depicted in Figure 5-2.

Figure 5-2. BLN Project Risk Management Process

In regard to project cost, 27 open risks are rated as critical, moderate, or minor level risks based on the BLN risk level matrix. Seventeen open risks are rated as critical, moderate, or minor level risks in regard to project schedule. Forty-five risks that were identified as part of the BLN project risk management process have been closed. Table 5-1 summarizes risks by level and status.

The most significant risks and their mitigation actions were discussed in Section 1.4, Project Risks.

Table 5-1. Summary of Critical, Moderate, Minor, and Closed Risks		
Level of Attention Necessary	**Severity Level or Status**	**Number of Risks Identified**
Requires a detailed risk response strategy and senior management attention. Risk owner closely monitors and controls the risk and keeps senior management informed. The most critical risks are also monitored by corporate management for Enterprise Risk Management purposes. Critical risks are the highest priority for the project.	Critical	11
Requires a detailed risk response strategy, but less senior management attention than critical risks. Carefully monitored by the risk owner, especially for project conditions that may result in critical status. Moderate risks are placed on the risk watch list for monitoring.	Moderate	27
Can be kept under control without a specific risk response strategy and senior management attention. Placed in watch list status and reevaluated at least quarterly by the risk owner to determine if project conditions change which affect their probability and/or impact.	Minor	6
Reviewed at least quarterly by the risk owner for any changes that would affect the closed status.	Closed	45
	Total Number of Risks Identified:	**89**

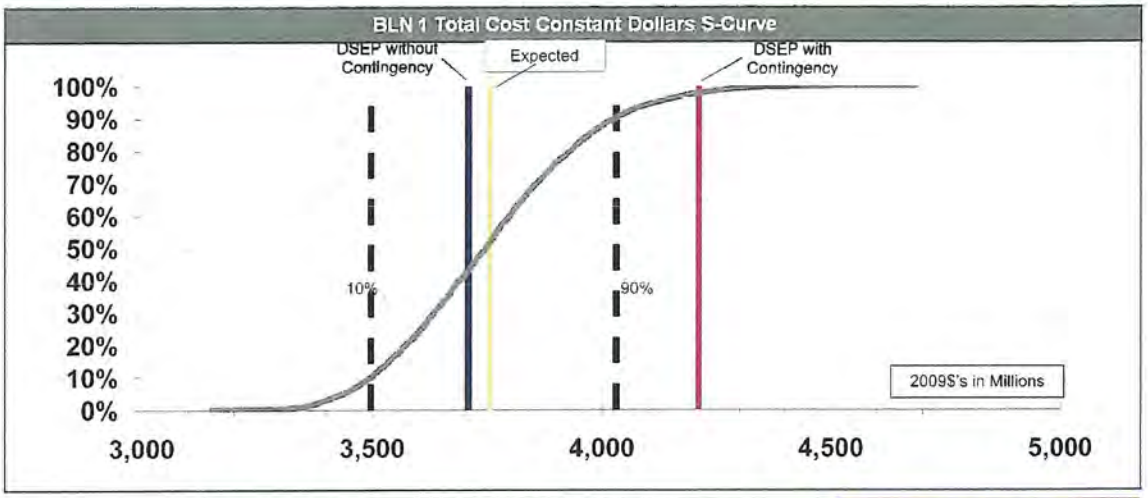
5.13 Huron Risk Analysis Results

As described in Section 5.12, Huron was retained to assist TVA in identifying and evaluating risks and their unmitigated cost and schedule impact associated with completing Units 1 and 2. The scope of the Huron assessment included risks outside of the control of the BLN project that are assessed and managed at the corporate level. Because the project Risk Register is limited to risks that can be managed at the project level, the Huron assessment is better suited for determining if the cost estimate contingency is fully supported by risk analysis results.

Figure 5-3 provides a comparison of the project cost estimate and the probable cost outcomes identified by Huron. The project cost estimate, including contingency, is very close to the 90% level of confidence determined by cost and schedule risk analysis. Therefore, the Huron risk analysis supports the contingency level used in the cost estimate.

Results BLN 1 – Total Costs (Constant Dollars)

Based upon a Monte Carlo simulation of 5,000 iterations, the following results were observed.



	Huron Preliminary Analysis of 2/22/10					TVA Estimate	
	Minimum Observed	10% Percentile	Expected	90% Percentile	Maximum Observed	DSEP without Contingency	DSEP with Contingency
BLN1 Total Cost	3.152	3.497	3.757	4.031	4.684	3.710	4.210

NOTE: The TVA Preliminary Estimate is depicted by the red vertical line on the figure. The green S-Curve is a Huron work product.

Figure 5-3. Huron Risk Analysis Results

Figures 5-4 and 5-5, respectively, depict the cost risk and schedule risk drivers of the Huron risk analysis. A risk map is provided as Figure 5-6.

Figure 5-4. Huron Cost Risk Drivers

Figure 5-5. Huron Schedule Risk Drivers

Nuclear Generation Development & Construction
NGDC Drill Down Risk Map: Bellefonte 1 Project

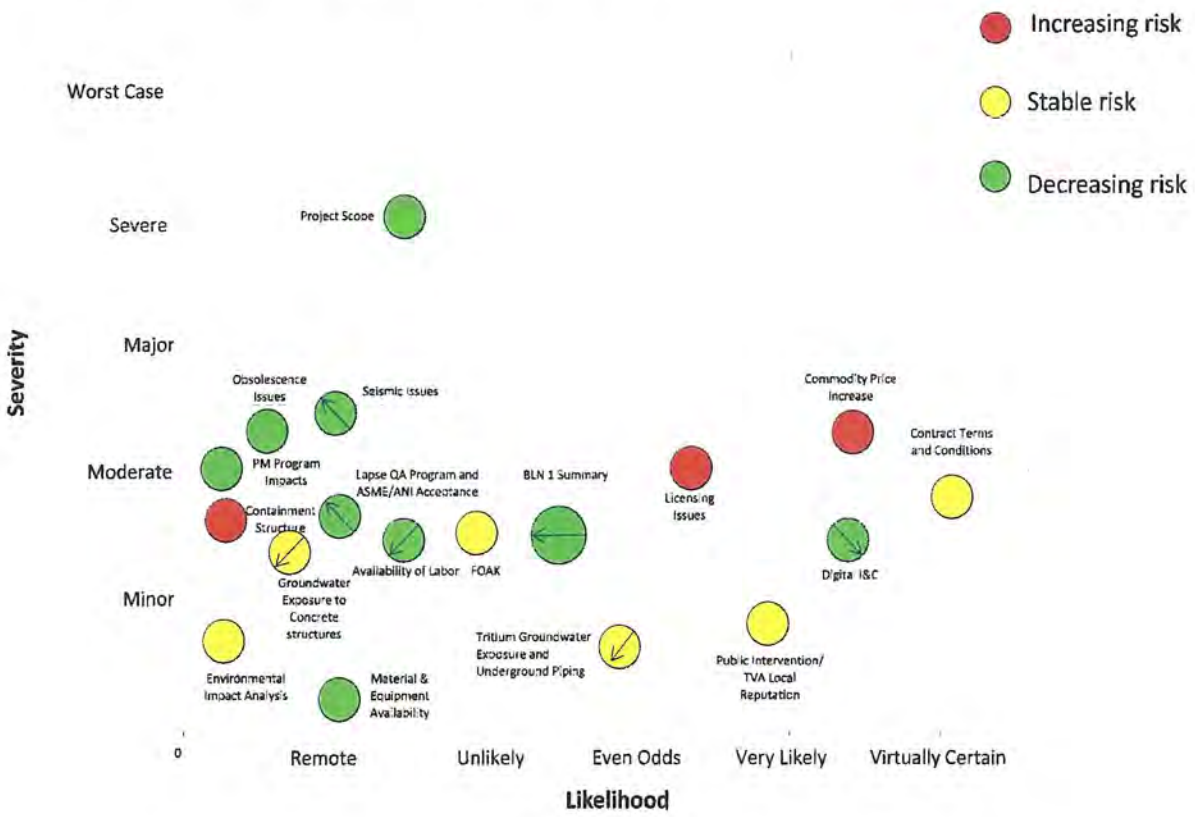


Figure 5-6. Risk Map

6 CONCLUSIONS

Scope: The scope of the project has been defined and validated through engineering studies that provide confidence in the estimate. Further, the scope is defined into the WBS which also includes costs for staffing (including training) the project for construction and operations. Bellefonte structures, materials, and equipment will be refurbished or replaced with state-of-the-art equipment that will meet regulatory requirements and ensure long plant life reliability while minimizing future Operation and Maintenance (O&M).

Licensing: The Licensing effort has resulted in the successful reinstatement of the Construction Permits, which establish the basic construction parameters for the units. A strategy has been developed to address significant regulatory issues, including the impact of new regulations, updating the BLN Operating License application and obtaining other licenses and permits necessary to achieve the timely issuance of an operating license in support of the scheduled date for commercial operation of BLN 1.

Cost: The estimate has been reviewed and validated based on the information available during the DSEP Project. The estimated cost will be $3.71 billion for Unit 1 with a contingency of $500 million. This estimate puts the cost at approximately $3,063 $/kW, based on 1260 MWe output.

Schedule: The project schedule for Bellefonte Unit 1 has been generated at Level 2 and is resource loaded. The schedule duration supports the October 2017 Commercial Operation date, and resources required to meet the schedule are reasonable and obtainable. The local craft availability has been verified, and professional personnel are readily obtainable, based on the current economic conditions and employment availability.

Risk: The project's risks have been reviewed by two independent groups. All risks can be addressed by the Project Team with mitigating solutions that fit within the budget and schedule.

Savings: Synergy of work product development should provide cost reduction opportunities that will be explored throughout the project. In addition, the team will gain efficiencies by getting workers from WBN as that project nears completion and begins de-staffing.

Transition to Operation: Interface with the Nuclear Power Group (NPG) has been established, and coordination for system turnovers and plant operation has been implemented. NPG personnel will work closely with the NGDC startup test group in accepting completed systems for the functional testing and operations required to ensure that the plant operates as designed. Bulk transfer of systems from NGDC to NPG will take place following the completion of hot

functional testing. A key factor here is that the Operations personnel are brought in early to coordinate with the construction effort to help with the system transition to operator control. This is an Institute of Nuclear Power Operations principal suggestion as indicated in publication INPO 09-007.

A division of responsibility with NPG is being developed to ensure alignment and a smooth transition from construction to power operations. Many of the attributes that are being put in place are as a result of improvements driven from lessons learned from previous projects.

Some key areas for improving NPG interface include:

- A Vice President responsible for the transition with strong background in B&W design and operation as well as construction and turnover experience in place.
- System reviews - A number of improvement opportunities have resulted from the detailed system reviews that the DSEP team has conducted. Options for system upgrades are being reviewed with NGDC when questions about need arise.
- Staffing plans are being reviewed as they are developed with NPG.
- NPG will take the lead to make critical staffing selections related to operations training and staffing to ensure that the right people are in place to support plant startup.
- Facilities plans including location of important plant areas to ensure worker efficiency.
- Procedure transition interface plan to ensure a smooth transition to full use of NPG procedures prior to fuel load. Procedures are being developed at Bellefonte now that are modeled to the greatest extent possible on NPG procedures to limit the impact when the NPG procedures are put into place.

7 REFERENCES

The following documents were used as references for this DSEP Report.

- "Bellefonte Nuclear Plant Definitive Estimate to Complete," January 1995 (White Book)
- "Bellefonte Nuclear Plant Unit 1 and Common – Cost Estimate to Complete," 1997 (Gray Book)
- "Bellefonte Nuclear Plant Completion Cost and Schedule Assessment," April 2008
- "Browns Ferry Unit 1 DSEP," May 2002
- "Detailed Scoping, Estimating and Planning (DSEP) Project Summary Report," Watts Bar Nuclear Plant (WBN) Unit 2, July 30, 2007
- "Watts Bar Nuclear Unit 2 Completion Project – DSEP Study Report," Revision 1, August 29, 2007

8 LIST OF ABBREVIATIONS AND ACRONYMS

ACRONYM	DEFINITION
AFUDC	Allowance for Funds Used During Construction
ANI	American Nuclear Insurers
AOV/MOV	Air Operated Valve/Motor Operated Valve
ASLB	Atomic Safety and Licensing Review Board
ASME	American Society of Mechanical Engineers
B&W	Babcock and Wilcox
BFN	Browns Ferry Nuclear Plant
BLN	Bellefonte Nuclear Plant
BLS	Bureau of Labor Statistics
BOIL	Bellefonte Open Item List
BOP	Balance of Plant
CADD	Computer Aided Design and Drafting
CAP	Corrective Action Program
CATD	Corrective Action Tracking Document
CCP	Coal Combustion Product
CD	Compact Disc
COIL	Consolidated Open Item List
CP	Construction Permit
DOE	Department of Energy
DSEP	Detailed Scoping, Estimating, and Planning
DVD	Digital Versatile Disc (formerly Digital Video Disc)
EQ	Environmental Qualification
FNM	Field Non-Manual
FOAK	First of A Kind
FSAR	Final Safety Analysis Report
FSEIS	Final Supplemental Environmental Impact Statement
FTE	Full Time Equivalent
HP	High Pressure
HVAC	Heating, Ventilation, and Air Conditioning
I&C	Instruments and Controls
INPO	Institute of Nuclear Power Operations
IPE	Individual Plant Evaluation
IPEEE	Individual Plant Evaluation for External Events
IR	Investment Recovery
kW	Kilowatt
LEED	Leadership in Energy and Environmental Design
LEV	Low Emission Vehicle
LP	Low Pressure
MW	Megawatt